OPERATING INSTRUCTIONS FOR

MODEL OT-3

Trace Oxygen Analyzer

P/N M74173
3/7/08
ECO#

DANGER

Toxic gases and or flammable liquids may be present in this monitoring system.

Personal protective equipment may be required when servicing this instrument.

Hazardous voltages exist on certain components internally which may persist for a time even after the power is turned off and disconnected.

Only authorized personnel should conduct maintenance and/or servicing. Before conducting any maintenance or servicing, consult with authorized supervisor/manager.

Warranty

This equipment is sold subject to the mutual agreement that it is warranted by us free from defects of material and of construction, and that our liability shall be limited to replacing or repairing at our factory (without charge, except for transportation), or at customer plant at our option, any material or construction in which defects become apparent within one year from the date of shipment, except in cases where quotations or acknowledgements provide for a shorter period. Components manufactured by others bear the warranty of their manufacturer. This warranty does not cover defects caused by wear, accident, misuse, neglect or repairs other than those performed by Teledyne or an authorized service center. We assume no liability for direct or indirect damages of any kind and the purchaser by the acceptance of the equipment will assume all liability for any damage which may result from its use or misuse.

We reserve the right to employ any suitable material in the manufacture of our apparatus, and to make any alterations in the dimensions, shape or weight of any parts, in so far as such alterations do not adversely affect our warranty.

Important Notice

This instrument provides measurement readings to its user, and serves as a tool by which valuable data can be gathered. The information provided by the instrument may assist the user in eliminating potential hazards caused by his process; however, it is essential that all personnel involved in the use of the instrument or its interface, with the process being measured, be properly trained in the process itself, as well as all instrumentation related to it.

The safety of personnel is ultimately the responsibility of those who control process conditions. While this instrument may be able to provide early warning of imminent danger, it has no control over process conditions, and it can be misused. In particular, any alarm or control systems installed must be tested and understood, both as to how they operate and as to how they can be defeated. Any safeguards required such as locks, labels, or redundancy, must be provided by the user or specifically requested of Teledyne at the time the order is placed.

Therefore, the purchaser must be aware of the hazardous process conditions. The purchaser is responsible for the training of personnel, for providing hazard warning methods and instrumentation per the appropriate standards, and for ensuring that hazard warning devices and instrumentation are maintained and operated properly.

Teledyne Analytical Instruments, the manufacturer of this instrument, cannot accept responsibility for conditions beyond its knowledge and control. No statement expressed or implied by this document or any information disseminated by the manufacturer or its agents, is to be construed as a warranty of adequate safety control under the user's process conditions.

Specific Model Information

The instrument for which this manual was supplied may incorporate one or more options not supplied in the standard instrument. Commonly available options are listed below, with check boxes. Any that are incorporated in the instrument for which this manual is supplied are indicated by a check mark in the box.

Instrument Serial Number: ________________________

Important Notice

Model OT-3 complies with all of the requirements of the Commonwealth of Europe (CE) for Radio Frequency Interference, Electromagnetic Interference (RFI/EMI), and Low Voltage Directive (LVD).

The following International Symbols are used throughout the Instruction Manual for your visual and immediate warnings and when you have to attend CAUTION while operating the instrument:

STAND-BY: Instrument is on Stand-by, but circuit is active

GROUND: Protective Earth

CAUTION: The operator needs to refer to the manual for further information. Failure to do so may compromise the safe operation of the equipment.

CAUTION: Risk of Electrical Shock

No Symbol

Note: Additional information in the form of notes are included which emphasize specific topics regarding the present discussion.

DANGER

COMBUSTIBLE GAS USAGE WARNING

This instrument is designed for CL1 DIV II hazardous locations. It is the customer's responsibility to ensure safety especially when combustible gases are being analyzed since the potential of gas leaks always exist.

The customer should ensure that the principles of operating this equipment are well understood by the user. Misuse of this product in any manner, tampering with its components, or unauthorized substitution of any component may adversely affect the safety of this instrument.

Since the use of this instrument is beyond the control of Teledyne, no responsibility by Teledyne, its affiliates, and agents for damage or injury from misuse or neglect of this equipment is implied or assumed.

CAUTION: **THE ANALYZER SHOULD ONLY BE USED FOR THE PURPOSE AND IN THE MANNER DESCRIBED IN THIS MANUAL.**

IF YOU USE THE ANALYZER IN A MANNER OTHER THAN THAT FOR WHICH IT WAS INTENDED, UNPREDICTABLE BEHAVIOR COULD RESULT POSSIBLY ACCOMPANIED WITH HAZARDOUS CONSEQUENCES.

This manual provides information designed to guide you through the installation, calibration and operation of your new analyzer. Please read this manual and keep it available.

Occasionally, some instruments are customized for a particular application or features and/or options added per customer requests. Please check the front of this manual for any additional information in the form of an Addendum which discusses specific information, procedures, cautions and warnings that may be peculiar to your instrument.

Manuals do get lost. Additional manuals can be obtained from Teledyne at the address given in the Appendix. Some of our manuals are available in electronic form via the internet. Please visit our website at: www.teledyne-ai.com.

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Introduction

1.1 Overview

The Teledyne Electronic Technologies Analytical Instruments (TET/AI) Model OT-3 is a microprocessor-based trace oxygen analyzer for real-time measurement of the parts per million of oxygen in inert gases, or in a wide variety of gas mixtures. It features simple operation, fast response, and a compact, rugged construction. Typical applications of the Model OT-3 include monitoring natural gas pipelines, wellheads, and compressor/blowers.

1.2 Main Features of the Analyzer

- The main features of the analyzer include:
  - Insta-Trace sensor technology
  - Stainless steel sample system (with PVC scrubber and Nylon cell block)
  - Pressure regulator
  - Coalescing filter
  - Acid gas scrubber (clear, rebuildable)
  - Flow control restrictor
  - Sample shut off valve
  - Bypass/filter drain valve
  - Flowmeter
  - Viewing window
  - Sample/Span selector valve
  - NEMA 4 enclosure (15.8” x 11.8” x 8.1”).
  - Viewing window 3300/OT-3 Control Unit

The Model 3300/OT-3 Control Unit has its own long list of features including:

- Keypad lockout feature
- Two user settable fail-safe alarms (with a user settable 0-20 min. time delay)
- Two user settable ranges (from 0-10PPM – 0-9999PPM) with user selectable auto-ranging.
- Power fail alarm
- SSR power output (Solid State Relay power available on AC control units)
- Micro processor based electronics 8 bit ADC & 18 bit DAC
- Large 3 ½ digit LED O2 concentration read-out
- 7 button user interface keypad
- Alarm condition indicator LED
- 100-240 VAC 50/60 Hz power (optional 9-36VDC)
- 0-10 VDC output
- 4-20 mA output
- 0-10 VDC range ID output
- Electronic temperature compensation
- Optional RS323 interface
- Accuracy: +/- 2% of range (at constant temp.)
- Response time: 90% in 65 sec of less @ 25 degrees C
- Temperature range (0-50 degrees C)

1.3 Front Panel Description

All controls are accessible from the front panel. See Figure 1-1. The front panel has seven push-button membrane switches, a digital meter, and an alarm indicator LED for operating the analyzer. These features are described briefly here and in greater detail in Chapter 4, *Operation*.

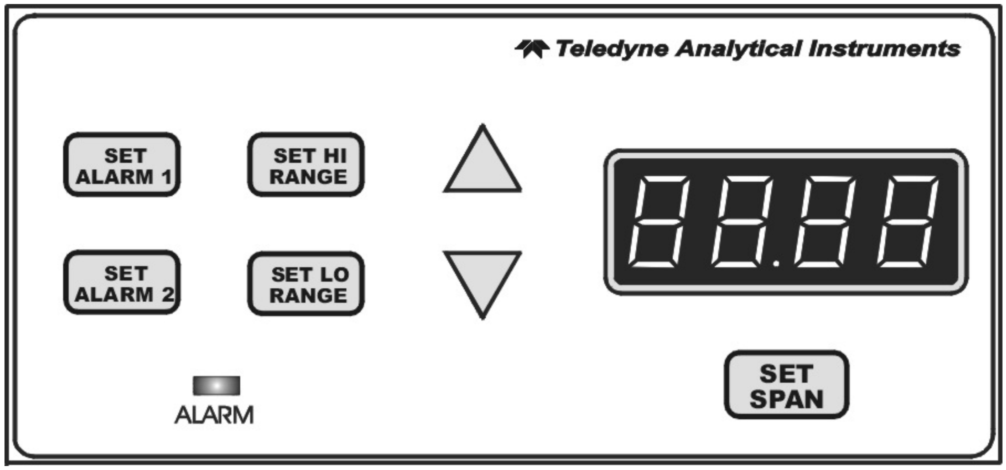


Figure 1-1: Front Panel

Function Keys:
Seven push-button membrane switches are used to select the function performed by the analyzer:

> **Set Alarm 1:** Set Alarm 1 Hi or Low, and the concentration at which alarm 1 activates.
>
> **Set Alarm 2:** Set the Alarm 2 Hi or Low, and the concentration to which alarm 2 activates.
>
> **Set HI Range:** Set the high analysis range for the instrument (up to 0-9999ppm).
>
> **Set LO Range**: Set the low analysis range for the instrument (down to 0-10ppm).
>
> **Set Span:** Span calibrate the analyzer.

Data Entry Keys: Two push-button membrane switches are used to manually change measurement parameters of the instrument as they are displayed on the LED meter readout:

> **Up Arrow:** Increment values of parameters upwards as they are displayed on the LED readout.
>
> **Down Arrow:** Increment values of parameters downwards as they are displayed on the LED readout.

Digital LED Readout: The digital display is a LED device that produces large, bright, 7-segment numbers that are legible in any lighting environment. It has two functions:

Meter Readout: As the meter readout, it displays the oxygen concentration currently being measured.

Measurement Parameters Readout:
It also displays user-definable alarm setpoints, ranges, and span calibration point when they are being checked or changed.

1.4 Rear Panel Description

The rear panel contains the electrical input and output connectors. The connectors are described briefly here and in detail in the *Installation* chapter of this manual. The rear panels for the AC and DC versions are different. Figure 1-2 shows the AC version while Figure 1-3 shows the DC version.

Power Connection AC version:
100–240 VAC, at 50/60Hz. The connector housing includes the fuse holder and AC Power cord receptacle.

Fuse Holder DC version:
Replacing the fuse is described in Chapter 5, *Maintenance*.

Analog Outputs:
0–10 VDC concentration output.
0–10 VDC range ID (or optional overrange) output.
4–20 mA DC concentration output, negative ground.

Alarm Connections:
Alarm 1, Alarm 2, and Power Failure Alarm connections.

Sensor Connector:
Internal Sampling System, Sensor Connector.

RS-232 Port:
Serial Digital Output of concentration and range signals.

SSR POWER (AC POWER UNITS ONLY):
+15 VDC power output for powering Solid State Relays.

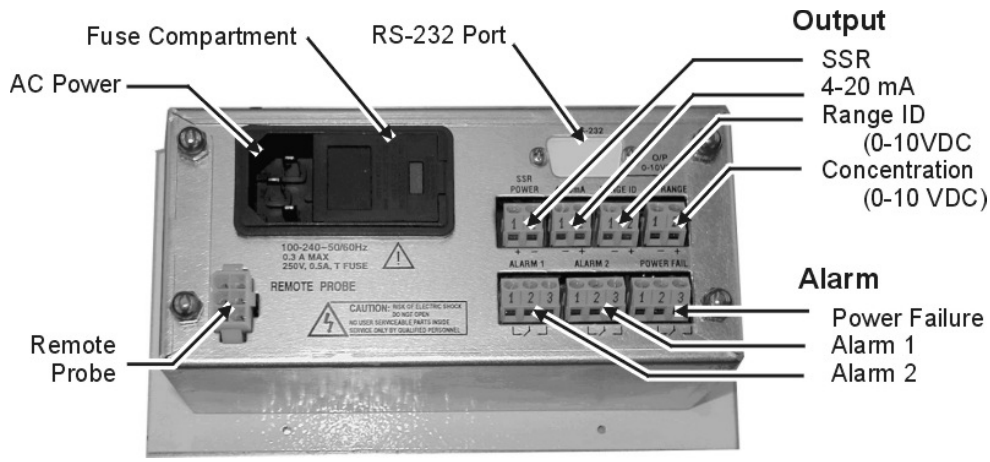


Figure 1-2: Rear Panel (AC Version)

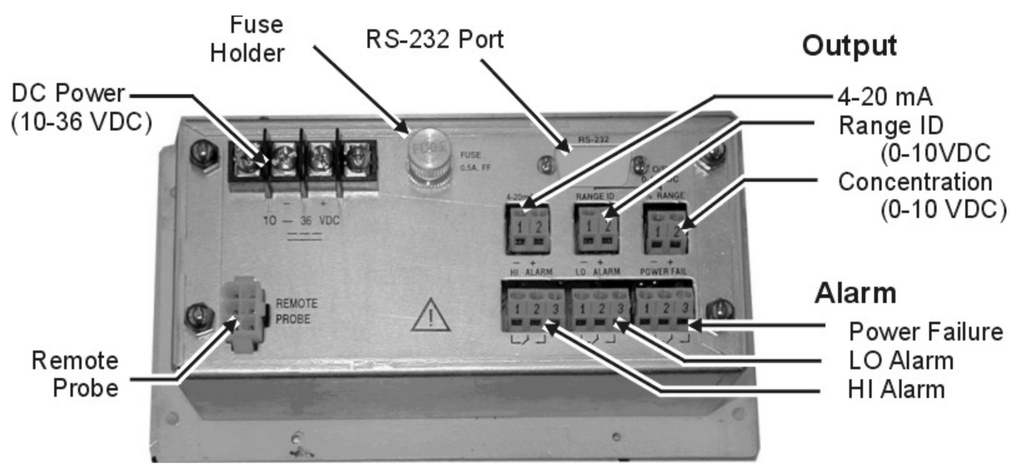


Figure 1-3: Rear Panel (DC Version)

Operational Theory

2.1 Introduction

The analyzer is composed of two subsystems:

- 3300/OT-3 control unit
- OT-3 sample sys.

The OT-3 sample system is designed to accept the sample gas and direct it to the sensitive surface of the Micro-fuel Cell sensor. The Micro-fuel Cell is an electrochemical galvanic device that translates the amount of oxygen present in the sample into an electrical current.

The 3300/OT-3 control unit processes the sensor output and translates it into electrical concentration, range, and alarm outputs, and a trace oxygen meter readout. It contains a microcontroller that manages all signal processing, input/output, and display functions for the analyzer.

2.2 Micro-fuel Cell Sensor

2.2.1 Principles of Operation

The oxygen sensor used in the Model OT-3 is a Micro-fuel Cell designed and manufactured by TAI. It is a sealed, disposable electrochemical transducer.

The active components of the Micro-fuel Cell are a cathode, an anode, and the aqueous electrolyte in which they are immersed. The cell converts the energy from a chemical reaction into an electrical potential that can produce a current in an external electrical circuit. Its action is similar to that of a battery.

There is, however, an important difference in the operation of a battery as compared to the Micro-fuel Cell: In the battery, all reactants are stored within the cell, whereas in the Micro-fuel Cell, one of the reactants (oxygen) comes from outside the device as a constituent of the sample gas being analyzed. The Micro-fuel Cell is therefore a hybrid between a battery and a true fuel cell. (All of the reactants are stored externally in a true fuel cell.)

2.2.2 Anatomy of a Micro-fuel Cell

The Micro-fuel Cell is made of extremely inert plastic (which can be placed confidently in practically any environment or sample stream). It is effectively sealed, though one end is a gas permeable membrane. At the permeable end a screen retains a diffusion membrane through which the oxygen passes into the cell. At the other end of the cell is a printed circuit board with concentric gold contacts.

Refer to Figure 2-1, *Cross Section of a Micro-fuel Cell*, which illustrates the following internal description.

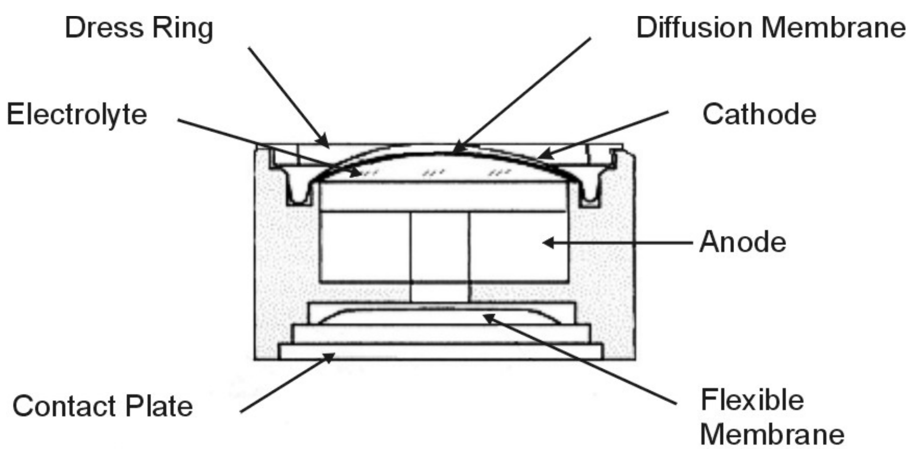


Figure 2-1: Cross Section of a Micro-fuel Cell

At the sensing end of the cell is a diffusion membrane, whose thickness is very accurately controlled. Near the diffusion membrane lies the oxygen sensing element—the cathode.

The anode structure is larger than the cathode. It is made of lead and is designed to maximize the amount of metal available for chemical reaction.

The space between the active elements is filled by a structure saturated with electrolyte. Cathode and anode are wet by this common pool. They each have a conductor connecting them, through some electrical circuitry, to one of the external contacts in the connector receptacle, which is on the top of the cell.

2.2.3 Electrochemical Reactions

The sample gas diffuses through the Teflon membrane. Any oxygen in the sample gas is reduced on the surface of the cathode by the following half reaction:

$$O_2 + 2H_2O + 4e^- \longrightarrow 4OH^- \qquad \text{(cathode)}$$

In this reaction, four electrons combine with one oxygen molecule—in the presence of water from the electrolyte—to produce four hydroxyl ions.

When the oxygen is reduced at the cathode, lead is simultaneously oxidized at the anode by the following half reaction:

$$Pb + 2OH^- \longrightarrow Pb^{+2} + H_2O + 2e^- \qquad \text{(anode)}$$

In this reaction, two electrons are transferred for each atom of lead that is oxidized. Therefore it takes two of the above anode reactions to balance one cathode reaction and transfer four electrons.

The electrons released at the surface of the anode flow to the cathode surface when an external electrical path is provided. The current is proportional to the amount of oxygen reaching the cathode. It is measured and used to determine the oxygen concentration in the gas mixture.

The overall reaction for the fuel cell is the SUM of the half reactions above, or:

$$2Pb + O_2 \longrightarrow 2PbO$$

These reactions will hold as long as no gaseous components capable of oxidizing lead—such as iodine, bromine, chlorine and fluorine—are present in the sample.

The output of the fuel cell is limited by:

(1) the amount of oxygen in the cell at the time and

(2) the amount of stored anode material.

In the absence of oxygen (or any gases capable of oxidizing lead), no current is generated.

2.2.4 The Effect of Pressure

In order to state the amount of oxygen present in the sample as a percentage of the gas mixture, it is necessary that the sample diffuse into the cell under constant pressure.

If the total pressure increases, the rate that oxygen reaches the cathode through the diffusing membrane will also increase. The electron transfer, and therefore the external current, will increase, even though the oxygen concentration of the sample has not changed. It is therefore important that the sample pressure at the fuel cell (usually vent pressure) remain constant between calibrations.

2.2.5 Calibration Characteristics

Given that the total pressure of the sample gas at the surface of the Micro-fuel Cell input is constant, a convenient characteristic of the cell is that the current produced in an external circuit is directly proportional to the rate at which oxygen molecules reach the cathode. This rate is directly proportional to the concentration of oxygen in the gaseous mixture. In other words it has a linear characteristic curve, as shown in Figure 2-2. Measuring circuits do not have to compensate for nonlinearity.

In addition, since there is zero output in the absence oxygen, the characteristic curve is close to an absolute zero. The cell itself does not need to be zeroed on ranges as sensitive as 0-10 ppm. The electronics are zeroed to compensate for zero offsets in the electronics. (The electronics is zeroed automatically when the instrument power is turned on during the Self-Test.)

As the cell reaches the end of its useful life, the slope seen in Figure 2-2 decreases. As this occurs, the span adjustments will become larger.

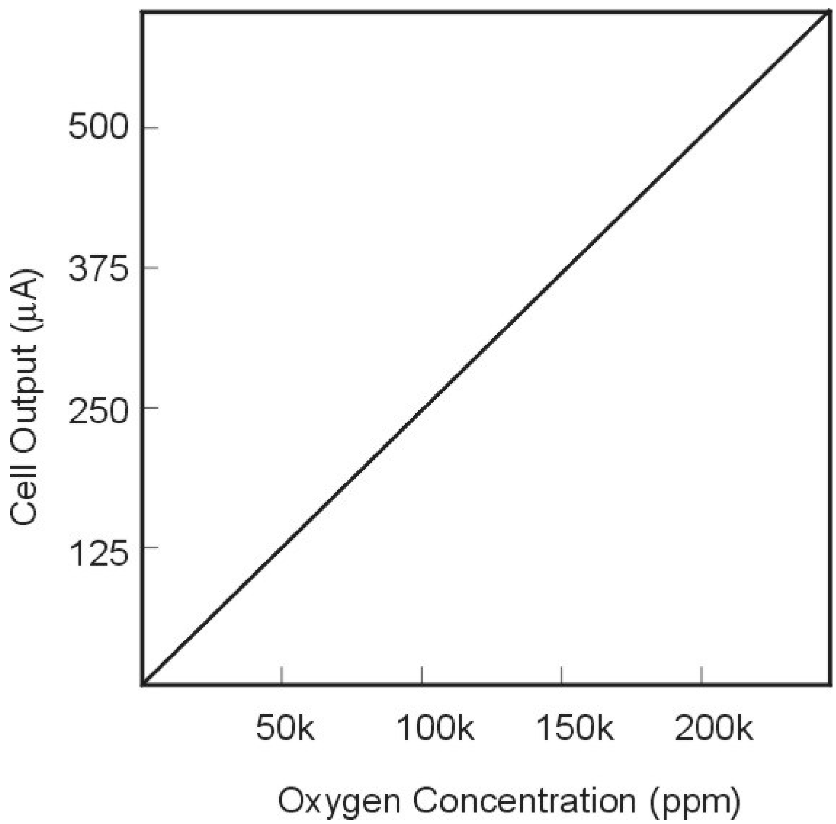


Figure 2-2: Characteristic MFC Input/Output Curve

2.3 Electronics

2.3.1 General

The signal processing uses an Intel® microcontroller with on-board RAM and ROM to control all signal processing, input/output, and display functions for the analyzer. System power is supplied from a universal power supply module designed to be compatible with most international power sources.

The power supply circuitry is on the Power Supply PCB, which is mounted vertically, just behind the rear panel of the Control Unit.

The signal processing electronics including the sensor amplifier, microcontroller, analog to digital, and digital to analog converters are located on the Main PCB, which is mounted vertically, just behind the front panel of the Control Unit.

2.3.2 Signal Processing

Figure 2-3 is a block diagram of the signal processing electronics described below.

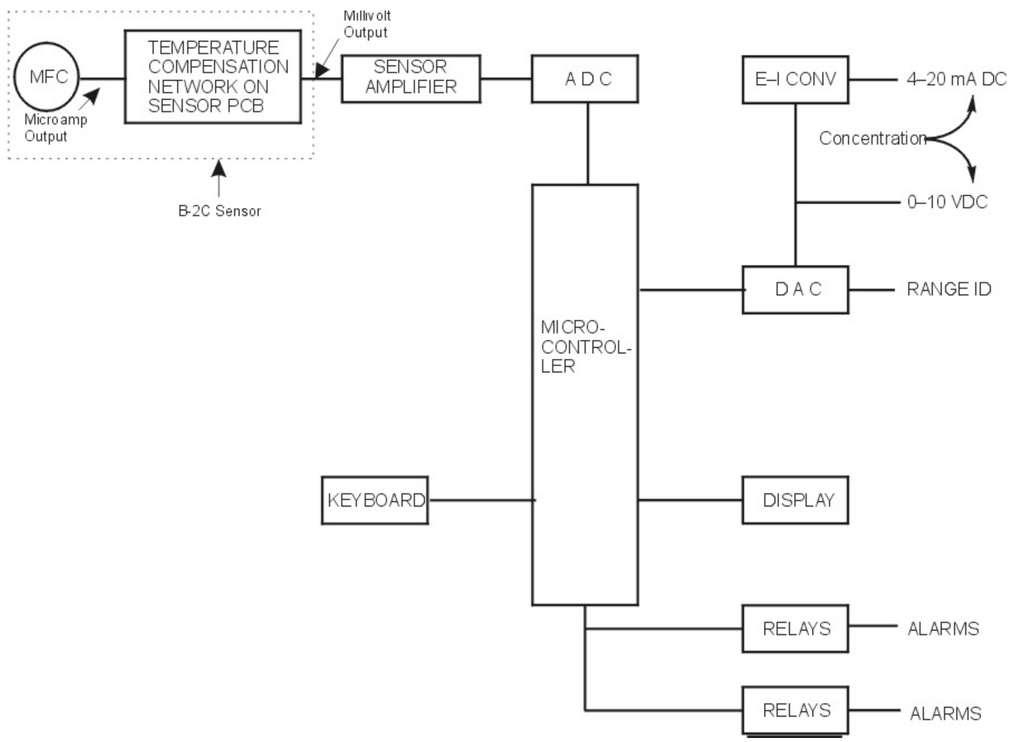


Figure 2-3: Block Diagram of the Signal Processing Electronics

In the presence of oxygen the cell generates a current. The sensor has an internal thermistor compensation network.

The output of the sensor is converted to voltage millivolt range. This output is fed to a voltage amplifier. The internal thermistor network provides temperature compensation of the sensor output. The resistance of the network changes with temperature, compensating for the changes of the Micro-fuel Cell output to temperature.

The output from the temperature compensation amplifier is sent to an analog to digital converter (ADC), and the resulting digital concentration signal is sent to the microcontroller.

The digital concentration signal along with input from the front panel buttons (KEYBOARD) is processed by the microcontroller, and appropriate output signals are directed to the display and alarm relays.

The same digital information is also sent to a 12-bit digital to analog converter (DAC) that produces the 0-10 V dc analog concentration signal and the 0-10 VDC analog range ID output. A voltage to current converter (E–I CONV) produces the 4-20 mA DC analog concentration signal.

Installation

Installation of the analyzer includes:

- Unpacking the system.
- Installing the Micro-fuel Cell
- Making the electrical connections.
- Making the gas connections.
- Testing the installation.

CAUTION: **READ THIS ENTIRE CHAPTER BEFORE INSTALLING THE UNITS.**

SAMPLE MUST BE FREE OF ENTRAINED SOLIDS OR WATER. HOWEVER, A HIGH HUMIDITY (NON–CONDENSING) SAMPLE IS IDEAL, SINCE IT WILL PREVENT WATER LOSS FROM THE CELL ELECTROLYTE.

THE MICRO-FUEL CELL SENSOR ELECTROLYTE IS CAUSTIC. DO NOT ATTEMPT TO OPEN IT. LEAKING OR EXHAUSTED CELLS SHOULD BE DISPOSED OF IN ACCORDANCE WITH LOCAL REGULATIONS. REFER TO THE MATERIAL SAFETY DATA SHEET IN THE APPENDIX.

ANY DAMAGE OR SCARRING OF THE DELICATE PERMEABLE MEMBRANE ON THE SENSING END OF THE CELL WILL REQUIRE CELL REPLACEMENT. PREVENT CONTACT WITH MEMBRANE BY ANY SOLID OBJECT.

3.1 Unpacking the Analyzer

As soon as you receive the instrument, carefully unpack and inspect the Unit, and any included accessories for damage. Immediately report any damage to the shipping agent. The analyzer is shipped with all the materials you need to install and prepare the system for operation.

CAUTION: DO NOT DISTURB THE INTEGRITY OF THE CELL PACKAGE UNTIL THE CELL IS TO ACTUALLY BE USED. IF THE CELL PACKAGE IS PUNCTURED AND AIR IS PERMITTED TO ENTER, CELL-LIFE WILL BE COMPROMISED.

3.2 Location and Mounting

This instrument should be installed at viewing level either indoors or sheltered from the moisture and the elements and mounted so it won't be subject to vibration. The ambient temperature should be within the range of 0-50°C (32-122°F). For the best performance, do not exceed 40°C (104°F).

In choosing a location for the analyzer, select a site that is as close as possible to the sample extraction point. This will enhance the overall instrument response time. If the analyzer is to be mounted in direct sunlight, minimize the solar heating by orienting it in a north or south facing direction.

3.2.2 Installing the Micro-fuel Cell

A Micro-fuel Cell is included as a separate item. It must be installed prior to instrument use.

Also, once it is expended, or if the instrument has been idle for a lengthy period, the Micro-fuel Cell will need to be replaced.

During the Installation and/or Replacement of the MFC, the membrane surface **MUST ALLWAYS FACE DOWNWARD TOWARD THE CELL CAP. The concentric gold contacts must face up**.

To install or replace the Micro-fuel Cell, follow the procedures in Chapter 5, *Maintenance*.

3.3 Electrical Connections

Figure 3-1 shows the Model 3300T/OT-3 rear panel of the control unit. (See Figure 1-3 for DC version). To gain access to the terminal blocks, the analyzer door screws must be loosened, and the door opened.

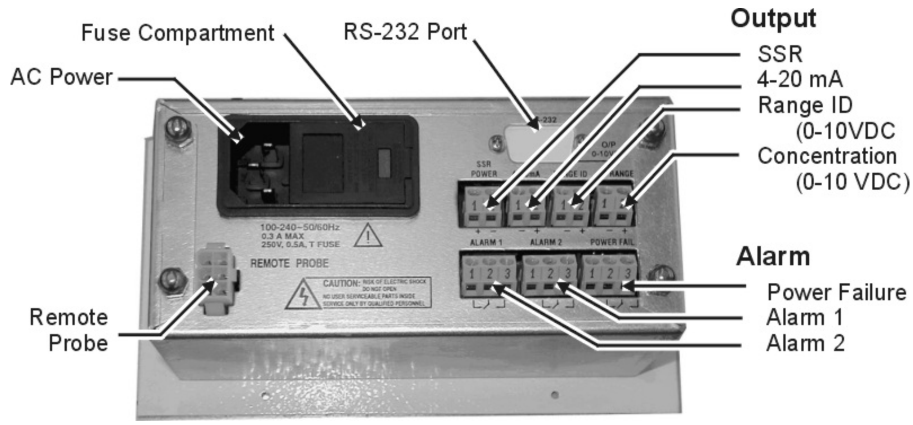


Figure 3-1: Electrical Connectors for AC Control Unit

3.3.1 Primary Input Power

A detachable power cord is installed directly into the Control Unit and connects to a three pin terminal block on the rear panel. The terminal block is provided for customer AC wiring.

The universal power supply allows direct connection to any 100-240 VAC, 50/60Hz power source. The fuse block, to the right of the power cord receptacle, accepts two 5x20mm 0.5 A, 250V, IEC time-lag (T) fuse. (See *Fuse Replacement* in chapter 5, *Maintenance*.)

For DC powered units, the customers DC power wiring is attached to the two pin terminal block located on the rear of the control unit. See Figure 1-3.

3.3.2 Analog Outputs

There are three DC (four on AC units) output signal connectors with screw terminals on the panel. There are two wires per output with the polarity noted. See Figure 3-1. The outputs are:

- 0–10 V % Range: Voltage rises with increasing oxygen concentration, from 0 V at 0 percent oxygen to 10 V at full scale percent oxygen. (Full scale = 100% of programmed range.)
- 0–10 V Range ID: 3.33 V = Low Range, 6.66 V = High Range, 10 V = Air Cal Range.

- 4–20 mA % Range: Current increases with increasing oxygen concentration, from 4 mA at 0 percent oxygen to 20 mA at full scale percent oxygen. (Full scale = 100% of programmed range.)
- SSR POWER (AC units only): Provides 15vdc at 698 ohm impedance to power external Solid State Relays.

3.3.3 Alarm Relays

The three alarm-circuit connectors are screw terminals for making connections to internal alarm relay contacts. There is one set of contacts for each type of alarm. Contacts are Form C, with normally open and normally closed contact connections capable of switching up to 0.2 ampere at 125 VAC into a resistive load (0.9A for 30 VDC).

The alarm relay circuits are designed for failsafe operation. In failsafe operation, the relays are energized during normal operation. If power fails the relays de-energize (alarms activated).

The contact connections are indicated diagrammatically on the rear panel as Normally Closed, Common, and Normally Open. Figure 3-2 explains how these act in failsafe operation.

Alarm 1 and Alarm 2 can both be configured as either HI or LO. A HI alarm will activate when concentration is above threshold, while a LO alarm will activate when concentration is below threshhold.

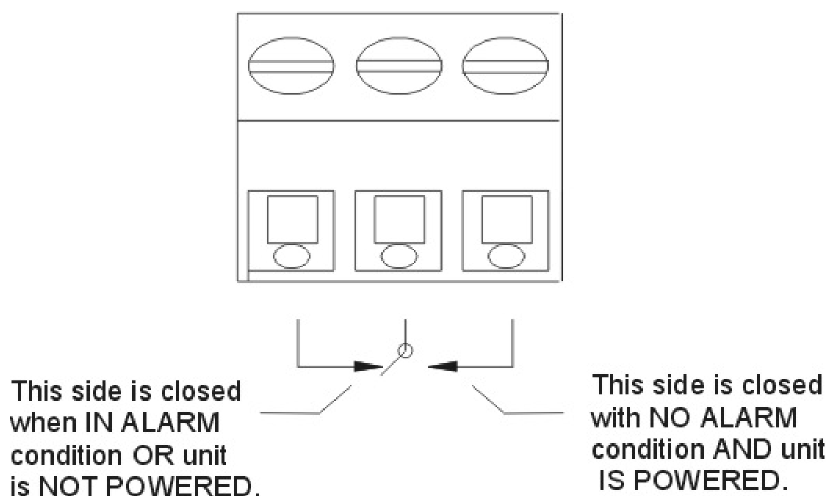


Figure 3-2: Contact ID for FAILSAFE Relay Operation

The specific descriptions for each type of alarm are as follows:

Power Fail Alarm: This alarm changes state when the AC or DC system power is lost.

Alarm #1: Programmable as high or low alarm (actuates when concentration is above threshold). Can be set anywhere between 0 and 9999ppm, but must be set ABOVE the threshold set for Alarm 2.

Alarm #2: Programmable as high or low alarm (actuates when concentration is below threshold). Can be set anywhere from 0 to 9999ppm.

CAUTION: THERE COULD BE HAZARDOUS VOLTAGE AT THE ALARMS TERMINALS, EVEN WHEN POWER IS REMOVED FROM THE INSTRUMENT.

3.3.4 Relay Ratings

The 3300/OT-3 has 2 relay ratings.

- **Higher rating** —established by the manufacturer

  DC Rating: 0-30 VDC maximum @ 2.0 Amps (resistive)

  AC Rating: 125 VAC maximum @ 0.5 Amps

  minimum reliable switching rating:
  10 µA @ 10mV

- **Lower rating**—maximum safe rating for Cl 1 Div 2 Group C or D hazardous location

  DC Rating: 0-30 VDC maximum @ 0.9 Amps maximum

  AC Rating: 125 VAC maximum @ 0.2 Amps maximum

  minimum reliable switching rating:
  10 µA @ 10mV

To safely use the alarm relays in a hazardous location, the characteristics of both the switched voltage and the components or load being operated must be known. The alarm relays must not be attached to any unknown power source, or any load or device that may exceed the safe use ratings for Cl 1 Div 2 Group C & D as listed above. It should also be understood that that these alarm relays can not be used to operate any inductive components such as mechanical relays or motors if this instrument is used in a hazardous location. **The higher contact ratings are applicable only when this system is installed in a general purpose, non-hazardous location.**

It is possible to switch loads that exceed the above ratings by using an external solid state relay (SSR). This type of relay is a fully potted semiconductor device with no moving parts. They are non-inductive and typically require 3-30 VDC at 5 mA to operate. These devices can safely control loads in excess of 6 amperes in both non-hazardous and hazardous areas. SSRs are available to handle either AC or DC loads.

3.3.5 Solid State Relay Output

The AC version of the 3300/OT-3 control unit is equipped with a SSR output on the rear panel. This output provides 15 VDC and ground through a 689 ohm resistor during an alarm condition. The output as configured is set for failsafe operation however, it can be set to non-failsafe by changing an internal jumper.

The output sends a command signal to drive external SSRs (not provided) during an alarm event. Using external SSRs will allow the 3300/OT-3 Control Unit to operate loads which exceed the safe use limits listed above for both non-hazardous and hazardous applications.

For DC versions of the 3300/OT-3 Control Unit, the DC service power can be switched through the alarm relays to operate a DC external SSR.

3.4 Gas Connections

The standard Model OT-3 incorporates a stainless steel sample system with a PVC scrubber and nylon cell block. All gas connections are made using the 1/8" stainless steel tube fittings provided on the bottom of the enclosure (¼" on the drain). There are three separate gas connections to be made plus a liquid drain connection:

- Sample gas
- Span gas (recommended concentration of 80-90% of the primary range of interest, balance N_2—typically 8-9 ppm or 80-90 ppm O_2 in N_2)

- Vent connection
- Coalescing filter drain

Note: Zero gas is not required however, see Section 5.2.1.

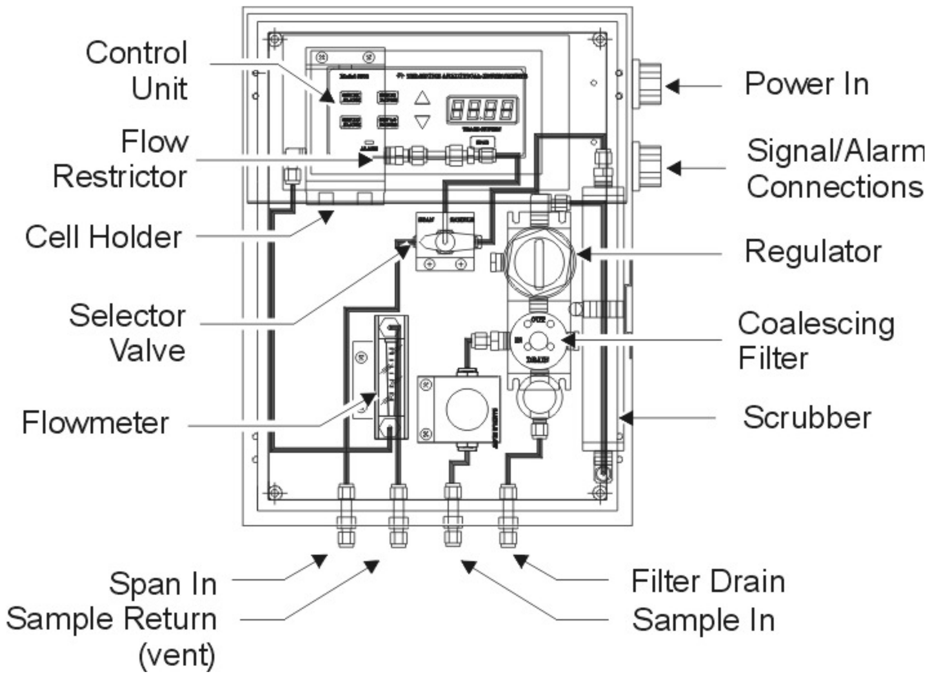


Figure 3-3: Gas Connections

To connect the gas lines, remove the fitting and ferrule and cone at the bottom panel. Insert the tubing into the fitting then place the ferrule and cone over the tubing. Mate the assembly back to the connector on the panel and tighten finger tight. Use a wrench to tighten an additional 1 ¼ turn beyond finger tight. You may have to hold the stationary fitting with another wrench to keep the entire fitting from turning. Figure 3-3 shows the gas connection panel.

CAUTION: TIE IN ONE LINE AT A TIME. MAKE SURE THAT THE CORRECT GAS LINE IS MATED TO THE PROPER FITTING ON THE INSTRUMENT.

For maximum performance, the system should be installed in a manner to minimize the sample line length.

The vent line must be installed in a manner which will prevent dirt and water from accumulating within the line. It must return sample to atmospheric pressure. The vent line should be 1/4" diameter tubing or larger and be at least 24" long. This will help to prevent the back diffusion of O_2 into the sample system.

3.5 Sample System

The sample system used in the OT-3 Trace Oxygen Analyzer is a robust gas handling and conditioning system designed for low flow rate trace oxygen analysis in a natural gas or other low-oxygen gas environment. It uses stainless steel tubing and fittings throughout and a special 0-10 psig regulator designed to provide stable sample flow at low volumes over wide temperature extremes. The incoming sample gas is conditioned using a coalescing filter and an acid scrubber to remove moisture and contaminants which would otherwise interfere with the accurate trace analysis and/or reduce the lifetime of the sensor.

Refer to Figure 3-4 for the following discussion.

Note: Check the front of this manual for any additional information in the form of addenda that may apply to your custom system.

Sample gas enters the system at 5-2000 psig. A shut off valve is installed and is used to switch gas flow on or off. The sample gas is passed through a horizontal coalescing filter to remove moisture and debris. This filter is designed to handle inlet gas pressure up to 2000 psig. It is important to periodically drain the condensate by opening the drain valve. If appropriate, the drain line should be connected to a suitable receptacle for handling contaminated waste liquid.

A 0-10 psig pressure regulator is installed downstream from the filter and controls the sample pressure through the analyzer. In conjunction with the flowmeter, it provides a stable mass flow even at low volume over the rated temperature range of the instrument. Set the pressure regulator to provide a flow rate of 0.4 SCFH (approximately 4 psig).

A clear PVC acid gas scrubber is installed between the regulator and the sample/span gas selector switch. The clear housing permits a visual analysis regarding the condition of the scrubber medium and allows the user to predict service intervals.

A switching valve is provided to feed the analysis unit with either sample or span gas.

A flowmeter and flow restrictor are parts of the sample system and assist in setting the flow of the gas. The restrictor is installed upstream of the analyzer while the flowmeter is installed on the vent side.

Adjust the sample pressure at the regulator to provide a flow rate of 0.4-0.5 SCFH. It is important that the sample vent connection does not restrict the sample flow. The sensor is designed to operate at atmospheric pressure. Restricting the sample vent line will pressurize the sensor, alter the O_2 reading, and reduce the sample flow.

Sample and Span pressure should not exceed 2000 psig (13.8 Mpa)

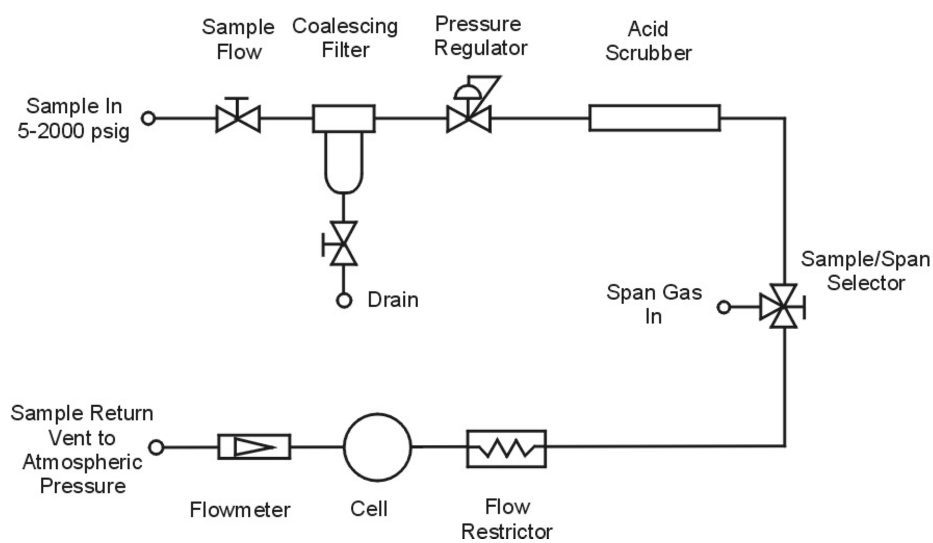


Figure 3-4: OT-3 Sample System

3.6 Installation Checklist

Before connecting the instrument to the power source and turning it on, make sure you have:

- Correctly installed the Sample and Exhaust gas lines
- Checked for leaks
- Set the flow

Once the above checks have been made, you can connect to the power source. The instrument is now ready for operation.

Operation

4.1 Introduction

Once the analyzer has been mounted, the gas lines connected and the electrical connections made, the Analyzer can be configured for your application. This involves setting the system parameters:

- Defining the user selectable analysis ranges.
- Setting alarm setpoints.
- Calibrating the instrument.

All of these functions are performed via the front panel controls, shown in Figure 4-1.

Analyzing for the trace oxygen level in the gas passing through the cell block is the default mode of operation. As long as no front panel buttons are being pressed the unit is analyzing.

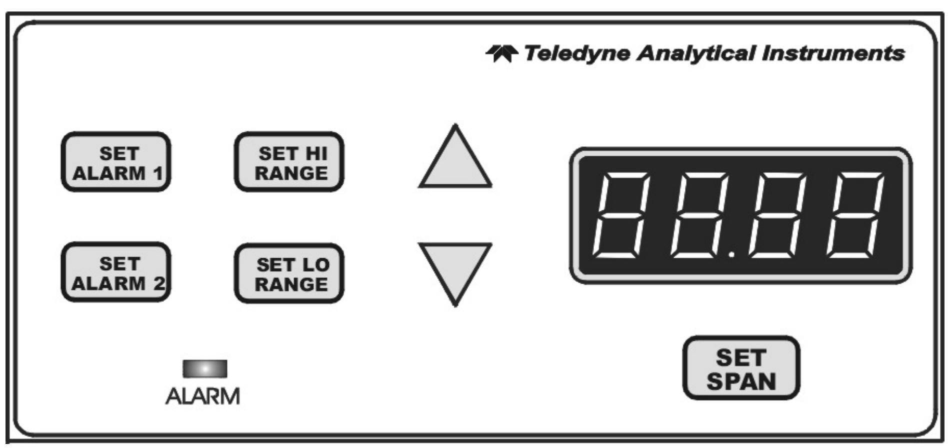


Figure 4-1: Front Panel Control and Indicators

4.2 Using the Function and Data Entry Buttons

When no buttons on the Analyzer are being pressed, the instrument is in the Analyze mode. It is monitoring the amount of oxygen in the sample gas that is flowing through the sampling system.

When one of the Function Buttons is being pressed, the Analyzer is in the Setup mode or the Calibration mode.

The 4 Setup function buttons on the analyzer are:

- SET ALARM 1
- SET ALARM 2
- SET HI RANGE
- SET LO RANGE

The Calibration mode button is:

- SET SPAN

The Data Entry buttons (Δ and ∇) increment the values displayed on the TRACE OXYGEN meter while one of the Function buttons is being held down.

Δ : UP arrow—increments the displayed value upwards.

∇ : DOWN arrow—increments the displayed value downwards.

Any of the functions can be selected at any time by holding down the appropriate button.

Each function will be described in the following sections. Although the operator can use any function at any time, the order chosen in this manual is appropriate for an initial setup.

4.3 Setting the Analysis Ranges

The two user definable analysis ranges are both capable of being adjusted for from 0-10ppm to 0-9999 ppm oxygen concentration. Whatever values are selected, the analyzer automatically switches from the LO range to the HI range when the oxygen concentration reaches the LO range full-scale value, and it switches back to the LO range when the oxygen concentration falls below of the LO range full-scale value

Note: The HI Range setpoint MUST be set at a higher concentration percentage than the LO Range setpoint.

4.3.1 HI Range

Setting the HI Range full-scale value defines the LEAST sensitive analysis range to be used. To set the HI Range:

1. Press the SET HI RANGE Function button once.
2. Immediately (within 5 seconds) press either the Δ or ∇ button to raise or lower the displayed value, as required, until the display reads the desired full-scale percent concentration.

4.3.2 LO Range

Setting the LO Range full-scale value defines the MOST sensitive range to be used. To set the LO Range:

1. Press the SET LO RANGE Function button once.
2. Immediately (within 5 seconds) press either the UP or DOWN arrow button to raise or lower the displayed value, as required, until the display reads the desired full-scale percent concentration.

4.4 Setting the Alarm Setpoints

The alarm setpoints can be adjusted over the full range of the analyzer (0-9999 ppm oxygen content). The set point values are expressed in ppm only.

4.4.1 Set Alarm 1

Alarm 1 can be set either as a high or low alarm. To configure this alarm to your preferences:

1. Press the SET ALARM 1 function button once.
2. The display will flash either HI or LO depending on what the alarm was configured in the last time. If the alarm configuration must be changed, use the Up or Down keys to toggle the alarm from HI to LO or vice-versa (if within 5 seconds no key is pressed, the instrument will return to the sample mode and display oxygen concentration).
3. To change the setting at which the alarm will be actuated, press the SET ALARM 1 function button once more. The alarm setpoint will flash on the LED display. Press either the Up or Down keys to raise or lower the displayed value, as required,

until the display reads the desired percent concentration. (if within 5 seconds no key is pressed, the instrument will return to the sample mode and display oxygen concentration).

After setting the value wait for the unit to time out of this mode (approximately 5 seconds) and return to displaying oxygen concentration.

4.4.2 Set Alarm 2

Alarm 2 can be set either as a high or low alarm. To configure this alarm to your preferences:

1. Press the SET ALARM 2 function button once.
2. The display will flash either HI or LO depending on how the alarm was last configured. If the alarm configuration must be changed, use the Up or Down keys to toggle the alarm from HI to LO or vice-versa. If within 5 seconds no key is pressed, the instrument will return to the sample mode and display oxygen concentration.
3. To change the setting at which the alarm will be actuated, press the SET ALARM 2 function button once more. The alarm setpoint will flash on the LED display. Press either the Up or Down keys to raise or lower the displayed value, as required, until the display reads the desired percent concentration. If within 5 seconds no key is pressed, the instrument will return to the sample mode and display oxygen concentration.

After setting the value wait for the unit to time out of this mode (approximately 5 seconds) and return to displaying oxygen concentration.

4.4.3 Power Failure Alarm

The power failure alarm provides a set of form C contacts and are configured for failsafe operation. The contacts remain energized when the whenever power is applied to the instrument.

4.5 Alarm Delay

The alarms have a user-settable delay feature which can delay the onset of an alarm. The delay can be set from 0-20 minutes in 1 minute increments.

When the alarms are set for delay and an alarm condition exists, the display will alternate between the O_2 reading and the time in minutes and seconds before the alarm will trigger. The alarm indicator on the front panel will blink on and off. The delay time will continue to count down until it reaches zero then the alarm relay will close. At this point the display will stop blinking and the O_2 concentration will display continuously. If a second alarm is reached after the delay time has elapsed, it will trigger immediately without any delay. If the O_2 level drops to below the alarm condition during the delay, the delay timer will reset to the full delay.

If the alarm delay is set to 0 and an alarm condition exists, the alarm indicator will blink and the alarm relay will close immediately. When the O_2 level drops out of the alarm condition, the alarm relay will drop out accordingly.

The alarm delay can be toggled on or off and the timing set through the DELAY function. To set the alarm delay:

1. Press the UP and DOWN arrow keys simultaneously. The display will indicate either PASS CODE or DELAY. If the display indicates PASS CODE, then to set the delay, press both arrow keys simultaneously again to toggle to DELAY.
2. While the display is blinking the word PASS DELAY, press the UP arrow key to increase the delay. To decrease the delay, press the DOWN arrow key. After three seconds the delay feature will time-out and return to the analyze mode.

4.6 Keypad Lockout

The Model OT-3 has a keypad lockout feature which is designed to prevent unauthorized changes to the analyzer. This feature is toggled on or off via the PASS CODE function. To enable the keypad lockout:

1. Press the UP and DOWN arrow keys simultaneously. The display will indicate either PASS CODE or DELAY. If the display indicates DELAY, then to set the lockout feature, press both arrow keys simultaneously again to toggle to PASS CODE.
2. While the display is blinking the word PASS CODE, press the up or down arrow key to alter the code number. Any number except 10 will lock the keypad.
3. After three seconds, the control unit will time-out and return to analyze mode. With the keypad locked, pressing the keys

will cause the display to flash NO PASS and the keys will have no effect.

4. To unlock the keypad, repeat steps 1 and 2. Enter the number 10 when the word PASS CODE blinks on the display.

4.7 Selecting a Fixed Range or Autoranging

The Model OT-3 can operate in fixed high, fixed low, or autoranging mode. These modes are user-selectable. To change modes:

1. Press and then release the SET HI RANGE and the SET LO RANGE buttons simultaneously.
2. Within 5 seconds, press either the Δ or ∇ button until Auto, Lo, or Hi displays on the LED, as desired.

After about three seconds, the analyzer resumes monitoring in the selected range mode.

Note: If the concentration exceeds 9999 ppm oxygen, the analyzer will automatically switch to the Calibration Range, EVEN THOUGH INSTRUMENT IS IN THE FIXED RANGE MODE.

4.8 Calibration

Preliminary—If not already done: Power up the Analyzer and allow the LED reading to stabilize. Set the Alarm setpoints and the full-scale ranges to the desired values.

Procedure:

Note: This procedure requires a suitable span gas with pressure regulation.

The O_2 concentration of the span gas should be 80-90% of the principle range of use— typically 8-9 ppm or 80-90 ppm.

1. Attach the pressure regulated span gas to the to the span port on the bottom of the analyzer as described in Section 3.4.
2. Move the gas selector valve to the SPAN position.
3. Adjust the pressure on the span gas to produce a 0.4-0.5 SCFH flow and allow the analyzer to stabilize before setting the span.
4. The analyzer reading should be stable prior to setting the span.

Note: If the analyzer output goes above the high alarm setpoint or below the low alarm setpoint, the display will go blank and the front panel ALARM Indicator, beneath the SET Function buttons, will blink. Hold down the SPAN button until the ALARM Indicator stops blinking.

To set the span:

1. Press the SPAN button once.
2. Within 5 seconds press either the Δ or ∇ button until the display is stable and matches the known span gas concentration.

The unit is now calibrated.

4.9 Displaying Percent & PPM on the LED Display

The analyzer displays the concentration in percent whenever the reading is over 9999 ppm. When the reading changes to percent, the LED display will flash the oxygen concentration on and off. On the other hand, if the instrument is displaying ppm, only the concentration reading will be shown.

4.10 Supplementary Information

If, during the Span Procedure, you pressed the SPAN button by mistake, you must wait five minutes for the analyzer to resume analysis or you can press the UP button and then the DOWN button. (Pressing the UP and DOWN buttons causes the analyzer to time-out in five seconds instead of five minutes).

If during the span procedure, you press the RANGE or ALARM buttons:

- either the range or alarm routine will be activated.
- any changes to span will be rejected.
- the 60 second alarm delay will not occur, i.e., the alarms will be responsive immediately.

CAUTION: TET/AI CONSIDERS THE ACTION OF PRESSING THE ALARM OR RANGE BUTTONS TO BE AT YOUR (THE USER'S) DISCRETION.

BE AWARE THAT THE ALARMS WILL BECOME ACTIVE WITHIN 5 (FIVE) SECONDS IF THE RANGE

OR ALARM BUTTONS ARE PRESSED DURING SPAN. THIS MAY RESULT IN FALSE ALARMS IF THE SPAN GAS HAS NOT BEEN FULLY PURGED FROM THE CELL AND SAMPLE LINES.

Maintenance

Aside from normal cleaning and checking for leaks at the gas connections, the Model OT-3 should not require any maintenance beyond replacement of expended Micro-fuel Cells, and perhaps a blown fuse. Routine maintenance includes occasional recalibration, as described in chapter 4, *Operation*.

5.1 Replacing the Fuse

CAUTION: ON AC UNITS, REMOVE THE POWER TO THE UNIT BEFORE REPLACING THE FUSE.

When a fuse blows, check first to determine the cause, then replace the fuse using the following procedure:

AC Units

1. On AC units, disconnect the power. Remove the power cord from the receptacle.
2. The fuse receptacle is located in the power cord receptacle assembly in the upper left-hand corner of the rear panel. See Figure 5-1.
3. Insert a small flat-blade screwdriver into the slot in the receptacle wall nearest the fuse and gently pry open the fuse receptacle. The fuse holder will slide out. There are two fuses in use and are visible in the clip.
4. Remove the bad fuse and replace it with a 5x20mm 0.5 A, 250 VAC, IEC time lag (T) fuse (P/N F1130).
5. Replace the fuse holder into its receptacle, pushing in firmly until it clicks.

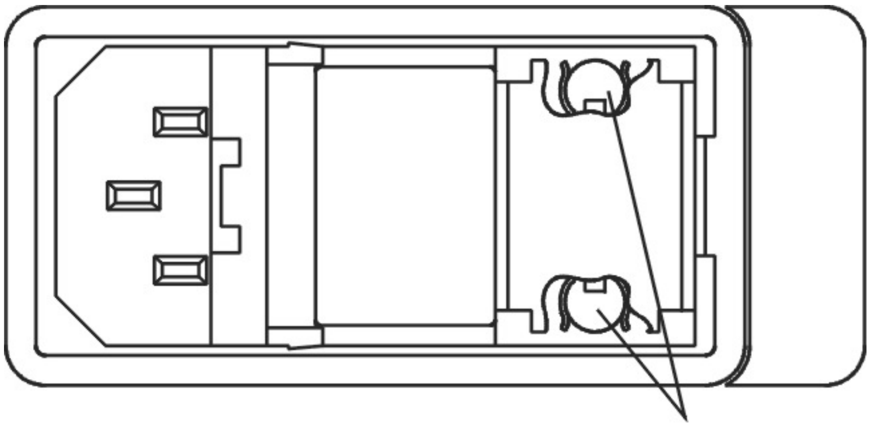


Figure 5-1: AC Fuse Replacement

DC Units

On DC units, the fuse is located in a fuse holder on the rear panel. See Figure 1-3. Unscrew the cap on the fuse holder and remove the blown fuse. Replace the fuse with a 1/2 A micro fuse P/N F91.

5.2 Sensor Installation or Replacement

5.2.1 When to Replace a Sensor

On trace analyzers the Micro-fuel Cell will typically fail due to excessive zero offset caused by loss of water. Large zero offsets will result in inaccurate SPAN settings. To test for this condition, purge the sensor and sample system with ZERO gas (typically nitrogen with less than 1 ppm O_2).

To do this, you should connect a pressure regulated zero gas source to the instrument at the span gas port. This can be done by either shutting off the span gas and replacing it with the zero gas supply or by teeing into the span gas line using a selector valve which can then feed either span or zero gas to the instrument.

It may take several hours for the sample system and cell to return to a stable low level of O_2 if it has been exposed to higher levels of O_2. If the instrument will not come down to an acceptably low reading on zero gas, then a depleted cell or a sample system leak should be suspected.

Typically offsets of 1.0 ppm or less are acceptable. A cell failure may also be indicated by an inability to SPAN, or slow response to changes in O_2 concentration at levels below 100 ppm.

CAUTION: READ THE SECTION *CELL WARRANTY CONDITIONS*, BELOW, BEFORE REPLACING THE CELL.

After replacing the Micro-fuel Cell, the analyzer must be recalibrated. See *Calibration* in Chapter 4.

5.2.2 Ordering and Handling of Spare Sensors

To have a replacement cell available when it is needed, TAI recommends that one spare cell be purchased when the current cell 's warranty period is approximately two thirds over.

CAUTION: DO NOT STOCKPILE CELLS. THE WARRANTY PERIOD STARTS ON THE DAY OF SHIPMENT. FOR BEST RESULTS, DO NOT ORDER A NEW SPARE CELL TOO SOON.

The spare cell should be carefully stored in an area that is not subject to large variations in ambient temperature (75 °F nominal), and in such a way as to eliminate the possibility of incurring damage.

CAUTION: DO NOT DISTURB THE INTEGRITY OF THE CELL PACKAGE UNTIL THE CELL IS TO ACTUALLY BE USED. IF THE CELL PACKAGE IS PUNCTURED AND AIR IS PERMITTED TO ENTER, CELL-LIFE WILL BE COMPROMISED.

WARNING: THE SENSOR USED IN THE MODEL OT-3 CONTAINS AN ELECTROLYTE WHICH INCLUDES SUBSTANCES THAT ARE EXTREMELY HARMFUL IF TOUCHED, SWALLOWED, OR INHALED. AVOID CONTACT WITH ANY FLUID OR POWDER IN OR AROUND THE UNIT. WHAT MAY APPEAR TO BE PLAIN WATER COULD CONTAIN ONE OF THESE TOXIC SUBSTANCES. IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH EYES WITH WATER FOR AT LEAST 15 MINUTES. CALL A PHYSICIAN. (SEE APPENDIX, Material Safety Data Sheet—MSDS).

5.2.3 Removing the Micro-fuel Cell

To remove a spent or damaged Micro-fuel Cell:

1. Disconnect the Power Source from the instrument.

2. Open the analyzer door.
3. Unscrew the cell-retainer cap from the cell block by turning it counterclockwise until it is free.
4. Withdraw the cap from the block. *The cell should come out with the cap.*
5. Carefully pull the cell off of the cap.

WARNING: DO NOT TOUCH THE SCREENED END OF THE CELL OR ANY FLUID THAT MAY BE LEAKING FROM IT.

6. Dispose of the cell in a safe manner, in accordance with all applicable ENVIRONMENTAL AND SAFETY laws.

5.2.4 Installing a Micro-fuel Cell

To install a new Micro-fuel Cell:

CAUTION: DO NOT SCRATCH, PUNCTURE, OR OTHERWISE DAMAGE THE SENSING MEMBRANE OF THE MICRO-FUEL CELL. IF THE MEMBRANE IS DAMAGED, THE CELL MUST BE REPLACED.

1. Examine the O-ring at the base of the cell-retainer cap, and replace it if it is worn of damaged.
2. Disconnect the Power Source from the Control Unit.
3. Set the flow rate to a high level (.5-1 SCFH).
4. As rapidly as possible complete steps 5-7.
5. Remove the new Micro-fuel Cell from its protective bag.
6. Place the cell on the end of cell-retainer cap with the concentric gold rings facing up.
7. Careful insert the cap and cell into the block, and screw the cap clockwise into the cell block until it is fully closed.
8. Reconnect the electrical power.

5.2.5 Cell Warranty Conditions

The B-2C , A-2C, and Insta-Trace Class Micro-fuel Cells are used in the Model OT-3. These cells are warranted for 6 months, with an expected life of 8 months from the date of shipment (under specified operating conditions—see Appendix). Note any Addenda attached to the front of this manual for special information applying to your instrument.

Note that the warranty period begins on the date of shipment. The customer should stock only one spare cell per instrument at a time. Do not attempt to stockpile spare cells.

If a cell was working satisfactorily, but ceases to function before the warranty period expires, the customer will receive credit toward the purchase of a new cell.

If you have a warranty claim, you must return the cell in question to the factory for evaluation.

Note: When returning cells for evaluation, do not install the shorting pin on the rear of the cell.

If it is determined that failure is due to faulty workmanship or material, the cell will be replaced at no cost to you.

Note: Evidence of damage due to tampering or mishandling will render the cell warranty null and void.

Appendix

A.1 Specifications

Ranges: Two user selectable ranges can be set between 0-10 ppm and 0-9999 ppm oxygen, and a 0-25 % (nominal) Air Calibration Range.

Signal Output: Voltage: 0–10 VDC, negative ground
Current: 4-20 mA, negative ground

Range ID: 0-10 VDC.

Display: Light emitting diode (LED) display.

Alarms: Two user-settable non-latching alarms, with user adjustable programmable 0-20 min.delay; one power failure relay. (All are failsafe.)

System Operating Temp: 0-50 °C

Accuracy: ±2 % of full scale at constant temperature
±5 % of full scale through operating temperature range (At 100 ppm and higher user defined ranges) once temperature equilibrium is reached.
±1 ppm for 10 ppm range under above conditions.

Response Time: 90 % in less than 65 seconds at 25°C (68°F).

System Power Requirement:

AC (100-240 VAC, 50/60Hz @ 2.8W), or DC (10-36 VDC @2.8W)

Weight: 30.9Lbs (14 Kg)

System Enclosure: NEMA 4 enclosure.
40 cm x 30 cm x 20.6 cm
(15.8” x 11.8” x 8.1”)

A.2 Spare Parts List

QTY	P/N	DESCRIPTION
1	C65220-A	PC Board, Main (std.)
1	C70740-A	PC Board, Power Supply AC (std.)
1	B73016	Micro-Fuel Cell Insta-Trace, A-2C (CO_2 type) or
1	C6689-A2C	Micro-Fuel Cell, Class A-2C, (CO_2 type), or
1	B71875	Micro-Fuel Cell Insta-Trace, B-2C type, or
1	C6689-B2C	Micro-Fuel Cell, Class B-2C
2	F1130	Fuse (AC), 1/2 A, 250 VAC, IEC Type T, 5 x 20mm
1	C74162-A	PC Board, Power Supply DC (std.)
1	F1605	Filter Elements (5 elements)
1	R2533	Restrictor (0.4 SCFH @ 4 psig)
1	R2588	Regulator
1	O182	O-Ring std. OT-3 Cell Holder
1	C74050A	Acid Gas Scrubber
1*	C74155A	3300/OT-3 Control Unit, AC, std.
1*	C74155B	3300/OT-3 Control Unit, AC, RS232
1*	C74155C	3300/OT-3 Control Unit, DC, std
1*	C74155D	3300/OT-3 Control Unit, DC, RS232
1	F51	Fuse (DC Units) 1/2 Amp Micro

* Depends on options chosen at time of purchase

IMPORTANT: Orders for replacement parts should include the part number and the model and serial number of the system for which the parts are intended.

Send orders to:

TELEDYNE ELECTRONIC TECHNOLOGIES
Analytical Instruments

16830 Chestnut Street
City of Industry, CA 91749-1580

Telephone: (626) 934-1500
TWX: (910) 584-1887 TDYANYL COID
Fax: (626) 961-2538

Web: www.teledyne-ai.com
or your local representative.

A.3 Reference Drawing

D-74110	Outline Diagram
B-74106	Piping Diagram
D-65305	Schematic main PCB
D-70739	Schematic AC Power Supply PCB
D-74161	Schematic DC Power Supply PCB
B-74224	Wiring diagram 3300/OT-3 ext. SSR drive.

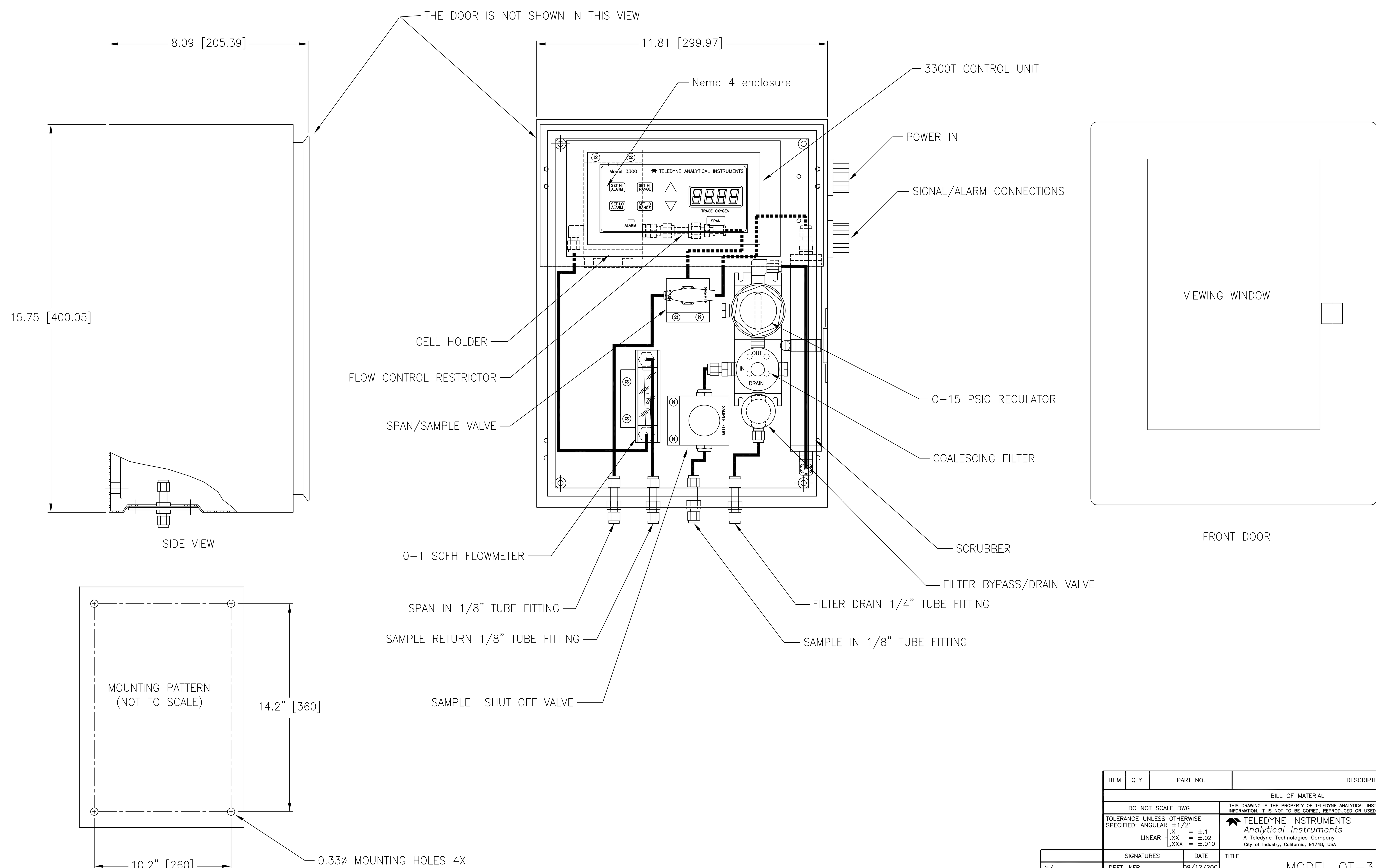
A.4 Miscellaneous

The symbol ~ is used on the rear panel of the Model OT-3 to signify volts alternating current (VAC).

Index

NOTES: UNLESS OTHERWISE SPECIFIED.
DIMENSIONS: INCHES [MM]

REVISIONS				
REV	DESCRIPTION	DATE	APP.	REV. BY
0	INITIAL RELEASE	02/12/03	KFP	--



ITEM	QTY	PART NO.	DESCRIPTION

BILL OF MATERIAL

DO NOT SCALE DWG

TOLERANCE UNLESS OTHERWISE SPECIFIED: ANGULAR ±1/2°
LINEAR .X = ±.1, .XX = ±.02, .XXX = ±.010

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City of Industry, California, 91748, USA

REFERENCE	SIGNATURES	DATE
N/	DRFT: KFP	09/12/200
I/	CHK:	
O/	APPR:	
P/ B-74106	ENGR: KFP	
F/ D-74173	C.O. 035141	
	CAD ID D74110-0	

TITLE: MODEL OT-3 OUTLINE DIAGRAM

SCALE 1:1 | SIM NONE | SHEET 1 OF 1

MATL.

DWG NO. D-74110 | REV 0

NOTES: UNLESS OTHERWISE SPECIFIED.

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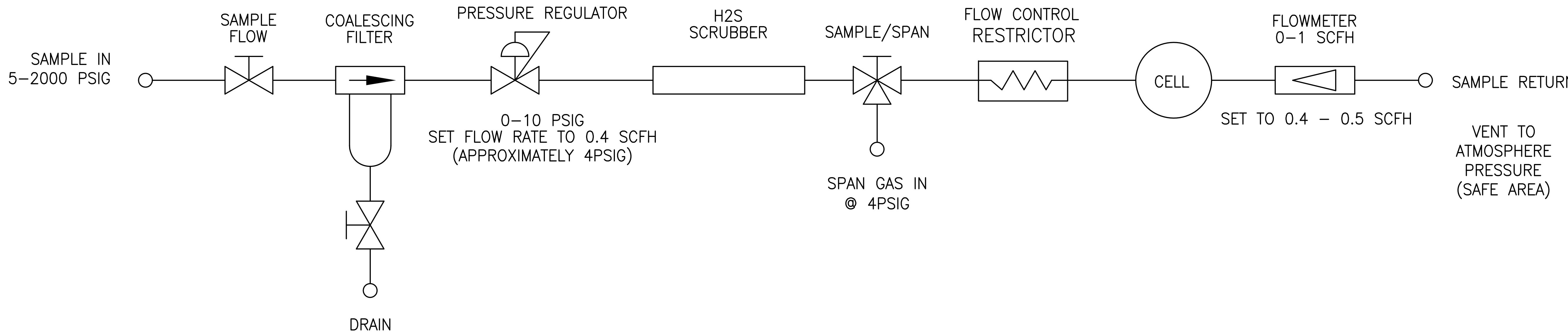

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LINEAR .X = ±.1, .XX = ±.02, .XXX = ±.010

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	SIGNATURES	DATE
S/		
N/	DRFT: KFP	08/13/01
I/	CHK:	
P/	APPR:	
O/	ENGR: KARL PENSON	
F/	C.O.: 035414	
REFERENCE	CAD I.D. B74106-1	

TITLE: MODEL OT-3 PIPING DIAGRAM

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SHEET 1 OF 1
MATL. NONE
DWG NO. B-74106
REV 1

NOTES: UNLESS OTHERWISE SPECIFIED.

EXTERNAL SSR INTERFACE FOR HIGHER POWER AC OR DC LOADS USING AC POWERED 3300/OT-3
CONSULT THE FACTORY FOR RECOMMENDATIONS ON SOLID STATE RELAYS

REVISIONS				
REV	DESCRIPTION	DATE	APP.	REV. BY
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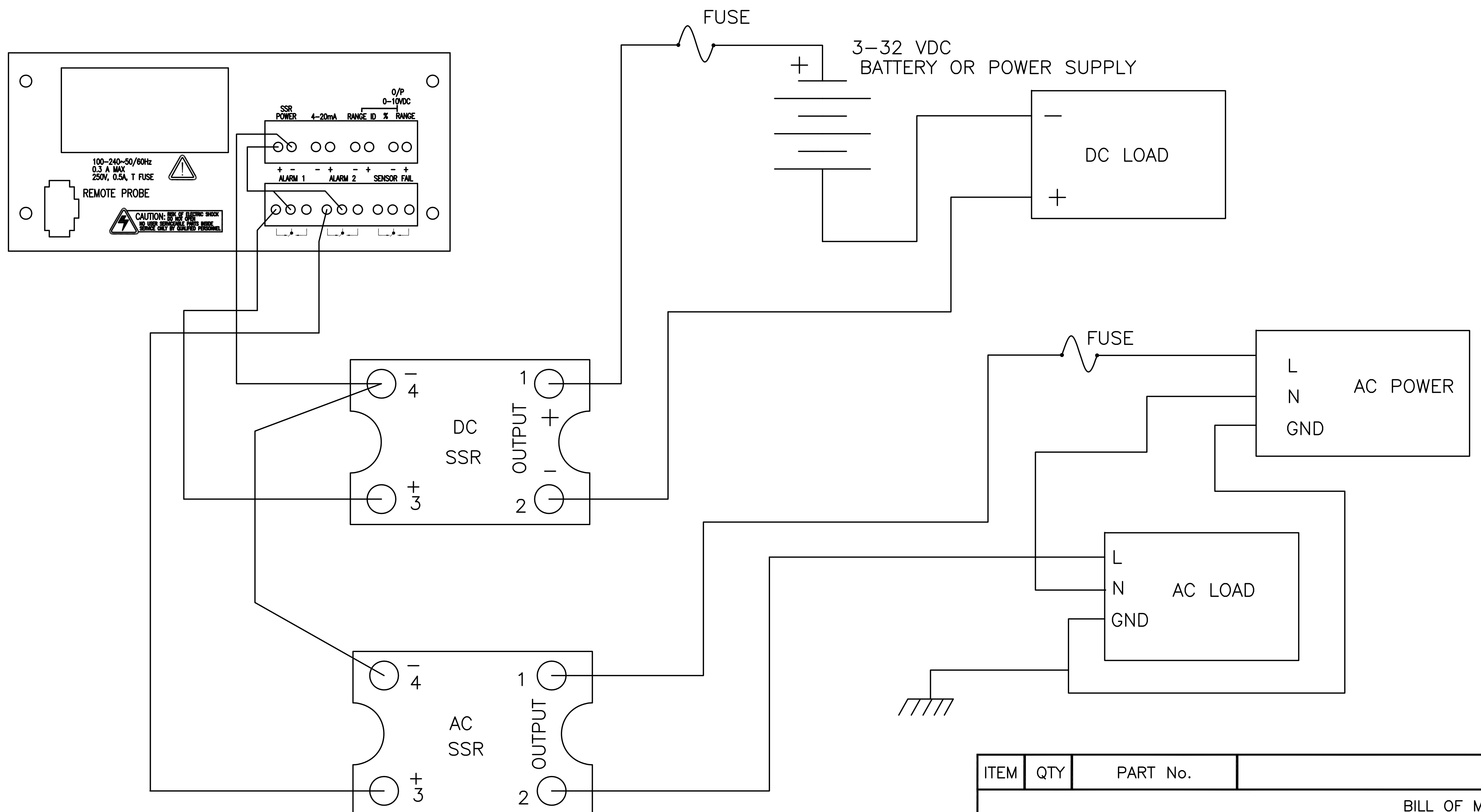

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BILL OF MATERIAL			

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LINEAR .X = ±.1, .XX = ±.02, .XXX = ±.010

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REFERENCE	SIGNATURES	DATE
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I/	CHK:	
P/	APPR: KFP	
O/	ENGR: Karl Penson	
F/	C.O.: 036146	
	CAD I.D. B74224-0	

TITLE: WIRING DIAGRAM 3300 (AC)/ OT-3 EXTERNAL SSR DRIVE

SCALE 1:1

SIM

SHEET 1 OF 2

MATL.

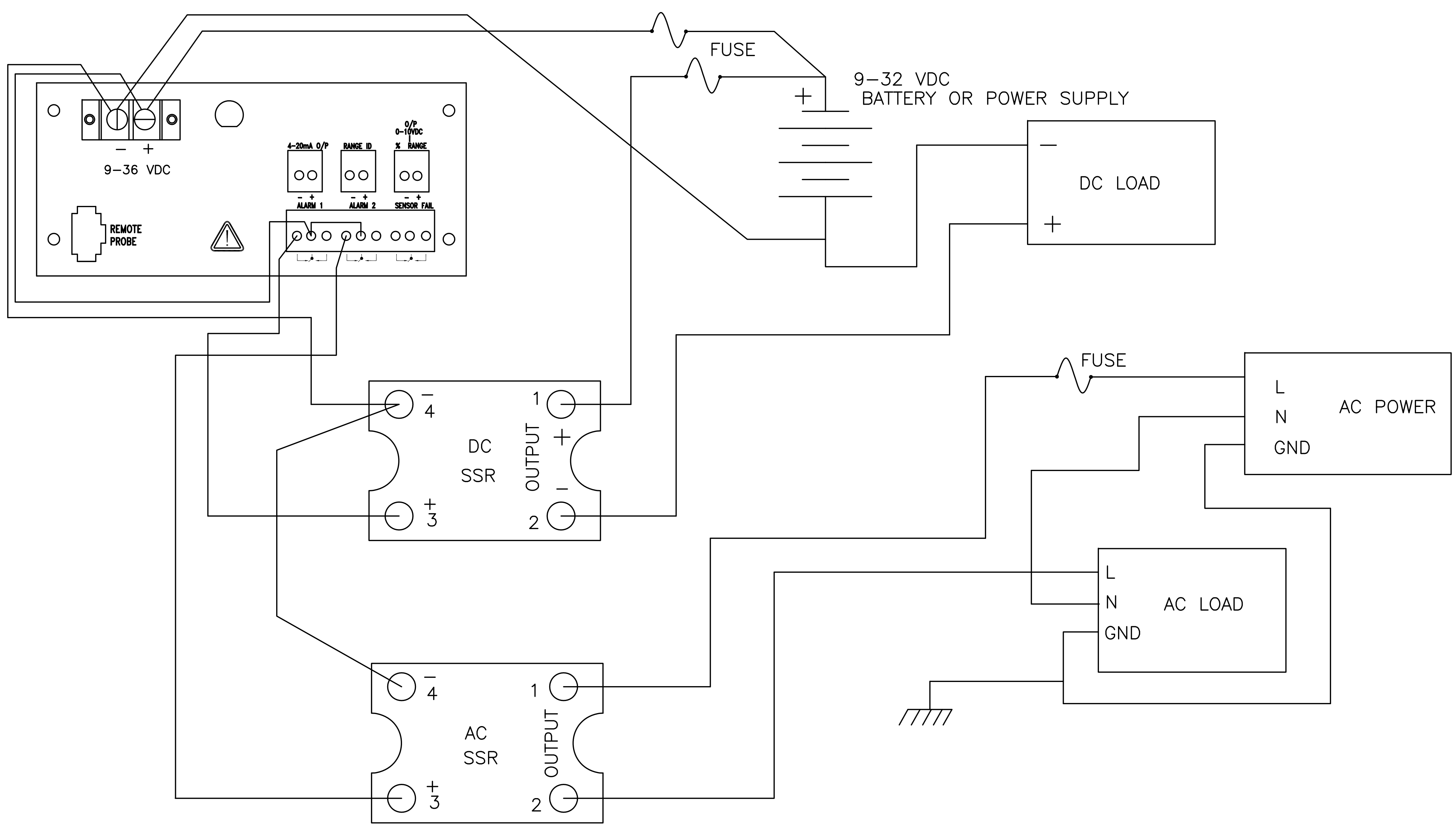
DWG NO. B-74224

REV 0

REVISIONS
SEE SHEET 1

NOTES: UNLESS OTHERWISE SPECIFIED.

EXTERNAL SSR INTERFACE FOR HIGHER POWER DC OR AC LOADS USING DC POWERED 3300/OT-3
CONSULT THE FACTORY FOR RECOMMENDATIONS ON SOLID STATE RELAYS



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